ANNUAL REPORT

Maryland Agricultural Experiment Station

1980 Annual Report

University of Maryland
College Park • Eastern Shore

Director's Letter

In my 4 years as director of the Maryland Agricultural Experiment Station, I have been witness to many accomplishments. Agricultural research scientists in Maryland have been pioneers in no-tillage research and this cost-efficient method of farming has found growing support among farmers. Farmers are interested in the savings of fuel, labor and time that minimum tillage provides. Pest control against such pests as johnsongrass and the Mexican bean beetle has also improved. If left uncontrolled, johnsongrass can destroy a crop, while the Mexican bean beetle can cost soybean growers hundreds of thousands of dollars a year. Our recent acquisition of the Wye Angus herd has placed us in an enviable position in the fields of beef cattle breeding and management. Our research is aimed at continuing the superiority of the herd and developing quality beef that will benefit both farmer and consumer. These are just a few of the areas in which our research is closely tied to the well-being of agriculture and the national economy.

Nevertheless, I have also been witness to declines in agricultural productivity growth while agricultural demands are increasing. Our domestic needs for more food and agricultural exports to help balance trade deficits, coupled with the growing world population, require a productivity growth in agriculture that will be a challenge to achieve. I do not intend to paint a bleak picture in regard to agriculture, for nothing could be further from the truth. As the second chapter in this report ably demonstrates, we are holding the line in agriculture. I merely want to emphasize that it is getting harder to do so each year. Agricultural research receives a small portion of the state budget and an even smaller amount from the federal budget. When one considers that the American farmers, who make up 3 percent of the population, must feed the entire country, the decreasing level of support is hard to comprehend. In future years I would like to be able to report to you of new accomplishments in agricultural research. With proper funding and support for research, I am confident that this will be possible.

As this publication goes to press, I would like to inform you of a significant discovery made recently by one of our botanists. The corn cyst nematode, a microscopic worm capable of reducing corn yields as much as 15 percent, was found in soil samples taken from four cornfields in Kent county. This was the first identification of this nematode in the United States. The Maryland Agricultural Experiment Station, in cooperation with agencies of the U.S. Department of Agriculture and the Maryland Department of Agriculture, already has begun research and containment activities at the site of the initial discovery.

W. L. Harris

Overview: Agricultural Research

Agriculture, the largest U.S. industry, is the success story of American science. Currently, 3 percent of the United States' population feeds the other 97 percent, and the number of people here and abroad who are fed by each American farm worker has risen from 15 to 70 since 1950. Also in the last 30 years, crop production per acre has risen by 45 percent and farm production per hour of labor has more than tripled. These achievements have occurred despite a reduction in the amount of farmland by nearly one-half.

Wholesale application of modern technology to American farming is the chief reason for current levels of productivity. Implementation of this technology, developed by research, has often determined the relative success or failure of the American farmer. What distinguished farmers who remained and prospered on farms while millions left farming in the 1950's was that they were willing to risk an investment in new technologies which were costly at first, provided they received long-range returns. These returns were usually forthcoming, as the achievements of agriculture since 1950 would suggest. The increase in crop yields has been the result of the implementation of the results of research concerned with the development of chemicals for weed, disease and insect control; the breeding and multiplication of new crop varieties; the production and marketing of seeds; the development of fertilizers; the development and manufacture of farm machines; and the increased educational background of the American farmer. Agricultural research is conducted nationally by the U.S. Department of Agriculture (USDA) and by private industry, while agricultural experiment stations do the majority of agricultural research at the state level.

The Maryland Agricultural Experiment Station, through its research efforts, has helped Maryland farmers maintain a prosperous agricultural industry in the state. Soybean research is a good example. In the past 15 years, the Experiment Station has released seven new varieties of soybeans which were developed to meet the needs of Maryland farmers and their environments. These varieties are now grown on more than 90 percent of Maryland's soybean acreage and, along with pest control practices developed by entomologists, have helped Maryland farmers increase their soybean yield per acre by 25 percent in the last 10 years.

Maryland broiler production, which increased approximately 40 percent in the last 10 years, is the sixth largest in the United States. Research has been instrumental in fighting poultry diseases that are dangerous to the industry. Research on a strain of infectious virus resulted in the development of a vaccine which has significantly reduced broiler losses in Maryland. Research has also helped reduce the time and feed required to grow broilers to market weight. In 1969, broilers used 2.2 pounds of feed per pound of live weight to reach market weight in 9 weeks, while in 1979 it took only 1.9 pounds of feed and 7.5 weeks to reach market weight.

The Wye Angus herd, owned by the University of Maryland, is a rugged and adaptable breed that is world famous for its superior beef quality.

The fine tradition of agricultural productivity in both Maryland and the United States will be severely tested as we move into the 1980's. There are three issues of particular concern: the domestic demand for food has expanded and is expected to remain strong; expansion of exports will be necessary to offset rising trade deficits; and the world population is growing faster than its food supply. In addition, agricultural productivity growth, which was 27 percent during the 1950's, has become nearly stagnant in 1980.

In order to deal successfully with these issues, agriculture needs a boost in productivity, one comparable to that created by hybrid corn. Its impact has been phenomenal. After genetically improving seed corn, agricultural experiment stations trial tested the new varieties. After witnessing the productivity of the hybrid plants on demonstration farms, farmers soon purchased hybrid seeds. Along with researchers, these farmers discovered that hybrid corn was valuable not only in terms of yield

but in terms of overall efficiency. Hybrid corn makes more efficient use of applied fertilizers, is resistant to some insects and diseases and, because of its uniformity and resistance to lodging, has helped make large-scale mechanization possible. Since the introduction of hybrid corn in 1930, the average yield per acre of corn in the United States has increased from 20.4 bushels to 101.2 bushels in 1978. Today about 95 percent of all corn planted in the United States is hybrid.

Presently, there are opportunities for breakthroughs in agriculture with the potential impact of hybrid corn, breakthroughs which could increase crop yields and animal production significantly.

In animal production, the process of embryonic transfer offers the possibility of one cow producing four or more embryos at one time. In this process, animal scientists use fertility drugs to bring about the production of additional eggs in selected cows. The cow is then bred either through artificial insemination or by bull. The fertilized eggs are then removed and placed in surrogate "donor" cows who carry the calf to term and add no genetic identification. On the average, a cow produces 10 eggs, of which 4 will produce calves. Embryonic production offers the opportunity for superior production of progeny because superior cows and bulls could be used in this process. The process has the potential for success in swine production as well.

Agricultural research aimed at increases in crop production is considering ways in which the high cost of nitrogen could be eliminated. Nitrogen is the most expensive element in crop production, both in terms of its cash cost and the energy required for its production. Leguminous crops, like soybeans, have the ability to make their own nitrogen. Current research is attempting to understand this process so that it can be applied to nonleguminous crops such as corn, which do not produce their own nitrogen and require the use of commercial nitrogen fertilizer. Scientists hope to develop a means to genetically transfer the nitrogen-fixing trait of legumes to nonleguminous crops.

These areas of research exemplify the types of productivity breakthroughs that agriculture needs to keep pace with the need for more food produced more efficiently. A lack of support for research means that implementation of new techniques will be slow to come. The result could be higher food prices and a higher trade deficit. How soon we can list the full potential of new agricultural concepts depends on the size of the American investment in agricultural research.

Eggs inoculated with antibodies are part of experiments to overcome the costly effects of infectious bursal disease, an avian disease, which destroys the immunological capabilities of birds.

Holding the Line

Insects, diseases and weeds are ever-present threats to the production capacities of farmers. Infestation by these pests can bring about the damage or destruction of crops, livestock and poultry, resulting in economic losses for farmers and food price increases for consumers. Control of these established pests is vital if American farmers are to maintain current levels of productivity.

Current weed and insect controls reflect the economic necessity to control pests even more efficiently. In 1979, Maryland farmers spent $13.6 million for pre-emergence chemical weed control on corn and soybeans. Additionally, about $2 million was spent for cultural methods of control and approximately $1.8 million for post-emergence chemical control. Nevertheless, weed competition and interference continue to cause annual losses of about 10 percent in these field crops.

Chemical control of insects is also a costly undertaking. In 1979, about 40 percent of the full season soybean acreage and 70 percent of the corn acreage were treated with soil/systemic insecticides at planting time as a preventive measure, at a cost of about $4.6 million. Foliar-applied chemical insect control cost farmers about $1.9 million in 1979. These high costs and the potential for damage to crops, livestock and poultry are the reasons for the major commitment of the Maryland Agricultural Experiment Station to research new ways of combatting these threats to agricultural production.

Integrated Pest Management

The problems spawned by widespread use of pesticides–increased insect resistance to pesticides, chemical residues in food and in the environment and the destruction of desirable insects–have prompted scientists to seek alternatives to the sole reliance on chemical control of pests. Integrated Pest Management (IPM) is one of those alternatives. IPM is a coordinated, multidisciplinary approach to pest control that emphasizes natural control whenever possible. The use of IPM techniques helps promote more efficient pesticide use, enabling the least amount of chemical control to help produce the best results. Those results usually include a reduction in crop loss, reduced expenditures on crop control, and consequently, a reduced need for food price increases. Furthermore, introducing fewer pesticides into the environment creates less potential for pesticide contamination of crops soil and water.

IPM systems use three major pest control tactics: biological, cultural and chemical. Biological tactics use the pest's natural enemies against it, as well as pest-resistant plants and insects sterilized by radiation.

Cultural tactics use crop planting modifications to control pests. For example, pests with relatively long life cycles can be controlled simply by planting a crop with a shorter growing season. Planting of trap crops, which are expendable and more attractive to pests, is another example of cultural pest control. The pests infest the trap crop, disregarding a more important one.

Chemicals are still an important means of pest control in the IPM system but are used only when pest populations approach levels which may result in economic loss. It is estimated that 75 percent of the use of soil/systemic insecticides in 1979 was unnecessary because the assumed insect infestation would not have reached a level of economic danger. Several research projects currently employ IPM methods.

Jimson Weed

The Jimson weed is a pest that hampers soybean crops in Maryland. A beetle that commonly feeds on the Jimson weed has occasionally reached a population high enough to completely defoliate it. Concerned that this high population might also have a detrimental effect on the soybean crop, researchers experimented to determine the true effects of the beetles on the Jimson weed and

Biological control of pests is part of Integrated Pest Management, a method which uses natural controls against crop pests whenever possible.

soybeans. It was discovered that the presence of these beetles reduced the detrimental effect of the Jimson weed on soybean crops by nearly 50 percent, while not significantly damaging the crop itself, proving that the beetles were an effective way of improving soybean yields.

Mexican Bean Beetle

The Mexican bean beetle can cost soybean growers hundreds of thousands of dollars a year, if uncontrolled. Research has involved the use of tiny wasps that consume Mexican bean beetle larvae. Based upon this research, the Maryland Department of Agriculture, in cooperation with the Maryland Cooperative Extension Service, has implemented a highly successful control program using this biological control.

Red Flour Beetle

Biological agents represent a promising solution to the problem of pests in stored products. These pests are responsible for billions of dollars in food losses yearly. In recently completed work, scientists found that the presence of parasites reduced the life span of the pests and their egg production. Scientists are currently studying the feasibility of using microscopic parasites to control the pests that infest stored grains, cereals, fruits, vegetables and nuts. The use of these parasites offers one way to effectively control pests that destroy food in storage.

Tobacco Hornworm-Budworm

In Maryland, the tobacco hornworm and tobacco budworm are the primary pests affecting Maryland's tobacco industry, which earned $34 million in 1978 in cash receipts. Research is geared to determining at what point these pests become serious crop threats; using new chemicals and determining their proper application; and determining the effect of natural control factors such as predators, parasites and weather on the distribution and population of these pests. It is hoped that this research will de-emphasize chemical control practices in favor of natural ones, thereby reducing the costs of controlling these pests.

The Experiment Station has placed IPM high on its list of research priorities, for it is clearly an opportunity to save dollars and improve the environment.

Chemical Control of Weeds and Diseases

Chemicals remain an important tool in the control of weeds. The shortage of available workers and the high cost of labor have made weed control by hand unreliable and uneconomical. In addition, while mechanical cultivation has been widely used, it does not provide the most efficient weed control.

Weed control scientists have conducted tests on various chemicals, including three for which they have obtained state registrations. Dinoseb is a chemical used to control black nightshade and morning-glory, weeds that compete with lima bean crops. The chemical Napropamide has been approved for use on tomatoes and provides superior grass control, giving full season control of weeds. Research has also resulted in registration of Terbacil, a pesticide which controls mare's tail, chickweed and henbit. These weeds compete with strawberries, and Terbacil provides excellent control and helps achieve cleaner strawberries.

Chemicals have also been important in the control of the blue mold fungus, a disease which attacks tobacco plants in all stages of their growth. This disease had become less of a problem in recent decades but reappeared and struck North American tobacco crops full force in 1979. About 15 percent of Maryland's tobacco crop was lost to this disease. Scientists have found that Ridomil, a fungicide, is effective in combatting this disease.

Integrated Pest Management practices are being used on tobacco crops in an attempt to decrease the use of chemical controls.

Disease Control in Animals

Scientists, in cooperation with USDA scientists at Beltsville, Maryland, are exploring ways to tap the immunological system of dairy cows in the fight against bovine mastitis, a disease which costs the U.S. dairy industry an estimated $1.3 billion per year.

The disease, which causes an inflammation of the cow's mammary gland, brings about a 5- to 30-percent reduction in milk production and also costs dairy farmers in culled cows, veterinary fees and drugs.

The scientists hope to develop methods that will stimulate the infected cow's immunal system and facilitate the movement of antibodies to the disease site. Such

an achievement would eliminate both the use of germicides and antibiotics to fight the disease and would reduce the possibility of introducing chemicals and antibiotics into milk products.

Infectious diseases are also a major economic problem for the poultry industry, one of Maryland's most important industries, and one which earned $260 million in cash receipts in 1979. Despite efforts to control these diseases, condemnations of broilers at processing due to disease is an annual and costly occurrence.

In an effort to overcome this problem, scientists have been studying a costly disease known as infectious bursal disease (IBD). The IBD virus destroys the immunological capabilities of birds when they are infected at a young age. This makes them susceptible to most common poultry disease agents and has caused the destruction of flocks devastated by numerous diseases. If the disease is detected before it reaches a critical stage, birds can be saved from condemnation due to disease. One way to protect the young birds is to ensure that breeder hens have a high level of antibody with which to fight the IBD virus. Experiment Station scientists have developed a simple method to measure the antibody levels in breeder hens. This method, called "Enzyme-Linked Immunosorbent Assay" (ELISA), can detect antibodies in chicken serum as early as 4 days after infection. Use of the ELISA test should expedite testing for antibodies against IBD and another disease, variant infectious bronchitis. ELISA test results compare favorably with results obtained from other tests commonly used to measure antibodies.

Integrated Pest Management, chemical control of weeds and diseases and methods that can diagnose and control animal diseases are all a part of the Experiment Station's effort to hold the line on crop and livestock damage.

Gamma counter equipment checks antibody levels in the fight against bovine mastitis, a disease affecting milk production in cows.

Growth of Agricultural Production

While farmers fight against pests and other threats to crops and livestock, they must continue to increase production levels to meet both increasing national and global demands. Scientists are investigating methods of increasing agricultural productivity through higher-yielding crop varieties and more efficient management systems for crops, livestock and poultry. Increasing productivity of animals is another part of this continuing research.

Increasing Yields in Crops

Soybeans rank among the top three cash crops in both the United States and Maryland, and researchers are seeking ways to increase yields while broadening disease resistance in soybeans.

The effect of narrow row spacing on crops is one aspect of the soybean research. Narrow row spacing allows for more plants per acre. These plants use light and nutrients equal to that used by plants in conventional spacings. While the normal spacing for soybean rows is 20 to 30 inches, row spacings of less than 12 inches have resulted in yield increases of 20 to 30 percent.

The Soybean Germplasm Collection, a collection of highly productive soybean lines from around the world, is an essential component of soybean research. In cooperation with the USDA, scientists can select soybean lines from this collection to evaluate their yield capability and their disease and insect resistance. Suitable lines from the collection are then used as parents to improve Maryland varieties.

Research in nitrogen fixation has demonstrated that residual nitrogen left in the soil from previous crops is used advantageously by subsequent crops. This allows a leguminous crop like soybeans, which produces nitrogen, to provide much of the nitrogen requirements of a nonleguminous crop such as corn, reducing expenditures on nitrogen fertilizers. Evidence suggests that if nitrogen fixation can be increased, crop yields will also increase.

While a great deal of research is devoted to the improvement of soybeans and other agronomic crops, other areas, such as horticultural crops, are receiving careful attention. In 1979, a new strawberry variety was released in cooperation with the USDA. The variety, named "Scott", has shown significant yield improvement–16 tons per acre as compared to the normal 10 to 13 tons per acre–and is resistant to red stele fungus, the leading disease of strawberries in the eastern part of the United States. The research from which "Scott" emerged is expected to provide four more superior strawberry selections in the next 3 years. Strawberry breeding conducted in Maryland is the most extensive in the eastern United States. (Maryland's strawberry varieties are some of the most popular east of the Rocky Mountains.) Researchers will also address the possibility of developing varieties that will breed throughout the summer, which would greatly expand the production and value of strawberries in Maryland.

New varieties of strawberries show increased yields and improved resistance to red stele fungus, a common disease of strawberries.

Animal Productivity Increases

Two of the ways in which attempts are being made to increase animal productivity are through advances in beef utilization and reductions in the maturation age of roosters.

Although bulls can be raised to market weight in less time than steers, bull meat is not of the same quality as standard beef, that which comes from a steer. In cooperation with the USDA, research efforts are determining whether or not the market quality of yearling bull meat can be improved through electrical stimulation of the carcass.

In the experiment, Hereford and Angus bulls are fed identical rations and weighed every 28 days to determine fat thickness. At a predetermined fat thickness, the animals are slaughtered, with one side of their carcass selected for testing. After the stimulation, corned beef, pastrami and flaked and formed steaks are prepared and tested for tenderness. It is hoped that this process will break down the muscle fiber in beef more rapidly than the process of natural aging, and provide a more tender product than has been marketed in the past. This process could allow bull breeders to receive greater economic benefits because it takes their product less time to reach market weight.

In the past, the reduction in the time and feed that it takes broilers to reach market weight has increased broiler production. Current research efforts may boost this production further. Scientists have discovered that when a painless incision is made on both sides of the

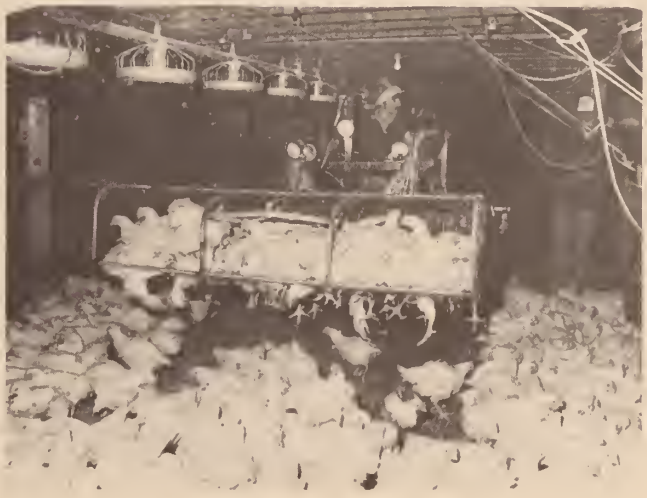
brain of a chick at 2 weeks of age, the chicks show accclerated growth of the testes. At 9 weeks of age the operated chicks are producing sperm. Normally, it takes 20 to 24 weeks before a rooster is sexually mature. Application of this procedure could increase broiler production with the increase in the number of mature roosters.

Greater Efficiency in Management

The study of mechanical alternatives to the traditional hand-catching and loading of broilers suggests that birds may be harvested in a manner that is less costly and less damaging.

Two alternatives were studied and compared with traditional methods. In one experiment, broilers were caught by a front-end loader with a scoop and carried to the bed of a live-haul truck, where they were removed by hand and placed in coops. In the other test, broilers were collected by a scoop and placed onto a conveyor that moved them to a truck bed where they again were removed by hand and placed in coops. Reduced bruising was sustained in both experiments and commercial application of these methods would increase the number of Grade A broiler carcasses, thereby increasing profits. Furthermore, the mechanical method requires fewer laborers than the hand-catching method.

Whether it be in the field, the broiler house or in any other agricultural domain, efforts such as these must continue in order to promote an increase in productivity and thereby meet the food needs of a growing world.



Experiments using a front-end loader equipped with a mechanical scoop to collect broilers have shown reduced bruising of chickens.

Challenges of the Eighties

Maryland farmers face a formidable challenge as they enter a new decade. They are faced with the tasks of increasing their productivity on decreasing farmland; producing a safe, nutritious, desirable product; protecting the environment; and conserving energy, while finding ways to cope with rapidly increasing production costs.

No-Tillage Agriculture

No-tillage agriculture is a practice which can be a key factor in dealing with the problems faced by Maryland farmers. Maryland is considered to be a national leader in the experimentation and implementation of no-till, a practice that involves the planting of a crop directly into the mulch and/or stubble of the previous crops. In 1979, 54 percent of the corn acreage and a substantial part of the soybean crop were planted this way. For corn, Maryland's major crop, this is an increase of 45 percent since 1970. It has been estimated that within the next 30 years in the United States 80 percent of five major annual crops–corn, sorghum, wheat, barley and rye–will be grown this way.

Adoption of no-tillage practices by the farmer enhances energy conservation as the need for machinery, fuel, time and labor is significantly reduced. No-tillage is accessible to small-scale farmers as well as large-scale farmers. In 1980, the machinery investment in conventional practices of tillage, based on 11 trips across the field, was $128 more per acre than no-till, which required an average of five trips across the field. An estimated 5 gallons of diesel fuel were saved per acre, and the amount of labor required was one-third of that used in conventional practices. The elimination of plowing and disking of the land, and the reduction in preparation and cultivation means that the farmer saves time as well as money. Recent research has shown that nitrogen, the most expensive element in crop production, is utilized more effectively by no-till corn when it is applied at recommended rates, often resulting in higher yields than conventionally tilled corn.

The beneficiaries of no-till farming include not only the farmer but the land on which he or she works. Soil conservation is aided greatly by this practice. Normally, an increase in tillage increases the amount of soil erosion, whereas no-till land, with its residue of stubble and mulch, controls the activity of wind and water that poses a threat to soil stability. In the hilly, Piedmont regions of the state, where an estimated 60 percent of farmland is farmed no-till, this lack of tillage makes the sloped land much less vulnerable to soil runoff caused by rainfall. The firm cover provided by no-till also provides for greater retention of water. This characteristic is especially important during dry growing seasons, such as the one experienced in 1980.

Probably the greatest economical benefit of no-till farming is the practice of multi-cropping, which encompasses all of the aforementioned benefits and increases their effect. In planting a second crop during the year, the soil is conserved to a greater extent and farm costs are reduced while productivity is increased. No-till farming does not fall behind in yield capabilities either. Research has shown that no-till yields are as high as conventional tillage yields and have the potential to yield even higher.

No-tillage agriculture does require more careful farm management. While there are fewer procedures to be followed, they are all essential and a single error is much harder to correct in no-till than in conventional tillage. No-till research conducted on experimental farms makes available timely information to Extension agents in each county who disseminate these findings to farmers.

No-till agriculture decreases the need for machinery, energy and labor. Also, it is less time-consuming and often increases crop yields.

Concerned about the possible pollution of the Cheseapeake Bay from herbicide run-off, researchers test the water quality of one of the Bay's tributaries.

Farmers also participate in management training seminars at the Princess Anne and College Park campuses of the University of Maryland and University research farms.

Additional research has begun on herbicide runoff in no-till, in cooperation with the USDA. Because land that is not tilled is more vulnerable to damage by insects and weeds, a need is created for increased use of insecticides and herbicides. However, there have been concerns that herbicides are responsible for aquatic grass damage and pollution in the Chesapeake Bay and its tributaries. In order to determine the effects of herbicides when applied near water, scientists have begun to measure herbicide movement on cornfields at the head of a tributary of the Wye River. First year preliminary results indicate that herbicide runoff was not substantial. However, since chemicals move from farmland when the land is eroded, and no-till farming greatly decreases erosion, there would seem to be little danger in this increased chemical application.

Energy Savings and Yield Improvements in Alternative Nitrogen Sources

As nitrogen is the most expensive element in crop production, research is seeking ways in which alternatives can be used for crop fertilization. It appears that the unwanted and costly sludge (dissolved air floatation skimmings, DAFS) from chicken processing plants has the potential to become a useful source of nitrogen. This would help not only farmers but also poultry processors who pay a high cost for removal of DAFS to treatment lagoons.

Research was done on test plots of corn. Corn plots fertilized with commercial nitrogen fertilizer yielded an average of 91 bushels of corn per acre, while plots fertilized with DAFS yielded an average of 124 bushels per acre. Estimates from poultry processors indicate that for every 1,000 processed chickens there is a pound of nitrogen (DAFS) available from these plants. With Maryland broiler production amounting to 2.5 million in 1979, this is an area that has great potential in terms of energy savings and yield improvements.

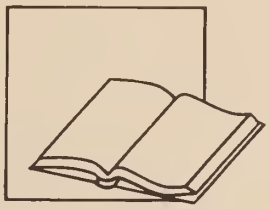
Energy Savings in Broiler Production

Recent poultry research has sought to lower production costs by lowering energy requirements in broiler production. Limited-area brooding is a system which places all chickens in 1/3 to 1/2 of the normal broiler house area and can reduce fuel costs by 50 percent in an experimental setting. When combined with a solar heater, these techniques saved 78.8 percent of the fuel required for heating the test facility under normal conditions. A similar system of operation on a commercial scale could meet 50 to 70 percent of the energy requirements for broiler production. Scientists have also found that reductions in brooder temperatures and light intensity can cut energy costs without harming broiler performance.

Summary

Agricultural production, no matter how abundant, cannot rest on past successes. Producing more food is one obvious way American farmers can keep pace with growing populations both here and abroad. Additionally, increases in energy conservation and environmental protection must accompany an increase in agricultural production. Studies such as those conducted at the Experiment Station represent a concerted effort to help farmers meet the increasing food needs of the world and conserve energy. Just as it has in the past, the Maryland Agricultural Experiment Station will continue to help insure stable, safe, productive agriculture in Maryland through the wise use of natural resources.

Projects and Publications 1979-80



The Maryland Agricultural Experiment Station was established to develop, conduct and disseminate research information. The research projects, based on recommendations from farm organizations, the Cooperative Extension Service, or the scientists' knowledge of research needs, are funded by state funds, through the Maryland state legislature, and federal funds, through the Cooperative State Research Service. In addition, Experiment Station scientists collaborate with scientists and engineers of the U.S. Department of Agriculture.

This knowledge is communicated to the agricultural community through Experiment Station miscellaneous publications and bulletins which reflect research findings. Experiment Station scientists frequently submit scientific articles to various professional journals. These articles reflect the Maryland Agricultural Experiment Station's reputation for research excellence.

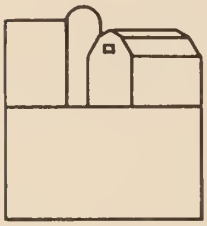
The following section lists projects, publications and scientific articles for 1978-79. Publications will be mailed free to all residents of the state who request them. Please address all requests to:

Agricultural Duplicating Services
2900 52nd Avenue
Hyattsville, MD 20781

Administration

Miscellaneous Publications

Sterile Acceptable Milk (SAM): A Major Energy Saving Technology - Summary and Recommendations. W.L. Harris, et al. **959**



Agricultural and Extension Education

Projects

Impact of In and Out Migration and Population Redistribution in the Northeast. J.W. Longest, D.L. Tweed. **T-25**

Behavioral Assessment of Crowding and Environmental Deterioration in Outdoor Recreation Settings. J.W. Longest, F.R. Kuss. **T-26**

Improving the Distribution of Socio-Economic Resources in Rural Areas. J.W. Longest, D.L. Tweed, J.W. Wysong. **T-27**

Communication Behavior of Publics Linked to the Maryland Agricultural Experiment Station. C.L. Nelson, J. Grunig, T. White. **T-28**

Scientific Articles

Differences in Reported Satisfaction Ratings by Consumptive and Nonconsumptive Recreationists. J.J. Vaske, M.P. Donnelly, T.A. Herberlein. Journal of Leisure Research. **A2801**

Hunter Attitudes Toward Wild Turkey Management in Maryland. J.J. Vaske, M.P. Donnelly, J.W. Longest, F.R. Kuss, C. W. Colton, D.L. Tweed. **A2766**

Mental Health Services and Their Interorganizational Support Systems in a Rural County. E.H. Owen, J.W. Longest. Presented at American Public Health Association. **A2699**

Labor Force Deconcentration in the United States: An Examination of the Relative Impacts of Intrasystemic and Intersystemic Movement. D.L. Tweed, J.W. Longest, E.H. Owen, P.A. Dabbs. Presented at the National Conference on Regional Population Distribution Change. Review of Public Data Use. **A2700**

Structural and Cultural Effects on Rural Services Delivery Systems. J.W. Longest, E.H. Owen, D.L. Tweed. Presented at the Fifth World Congress of Rural Sociology. **A2948**

Theoretical Constraints for a Model of Nonmetropolitan Population Change. D.L. Tweed, P.A. Dabbs, J.W. Longest, E.H. Owen. Presented at the Fifth World Congress of Rural Sociology. **A2946**

Evaluation of Alternative Strategies of Interorganizational Analysis of a Community Service Delivery System. E.H. Owen, J.W. Longest, D.L. Tweed, B.H. Powell. Presented at Rural Sociological Society Meetings. **A2945**

Note on the Squared Multiple Correlation as a Lower Bound to Communality. D.J. Jackson, D.L. Tweed. Psychometrika Journal. **A2947**

Perceptions of Crowding and Resource Quality by Early and More Recent Visitors. J.J. Vaske, M.P. Donnelly, T.A. Heberlein. Leisure Sciences. **A2944**

Miscellaneous Publications

Smith Island Library Services. J.W. Longest, M. Konan, C. Larsen. **953**

Turkey Hunters in Maryland: A Comparison with Hunters and Fishermen in the Midwest. M.P. Donnelly, J.J. Vaske, J.W. Longest, F.R. Kuss, C.W. Colton, D.L. Tweed. **955**

Agricultural and Resource Economics

Projects

Dairy Adjustments and Supply Response in Maryland and the Northeast. J. Wysong. — A-18-AU

Optimum Economic Management Plans for Loblolly Pine Plantations in the Mid-Atlantic United States. I. Hardie. — A-18-DA

Comparative Impact of Current and Alternative Systems of Taxation on Farmers and Counties. S. Ishee. — A-19-AC

An Economic Analysis of Agricultural Employment, Unemployment and Productivity Changes in Maryland, the Northeast and United States. J. Wysong. — A-19-AJ

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Economic Analysis of the Racing Industry in Maryland. R.G. Lawrence, J.J. Ahern. — A-26-CU

Economic Impacts of the 200-Mile Limit on Rual Northeastern Coastal Communities. I.E. Strand, V.J. Norton. — A-26-CV

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Measuring the Cost of Time in Recreation Demand Analysis. K.E. McConnell, I.E. Strand. American Journal of Agricultural Economics. — A2815

Energy Accounting: The Case of Livestock Feed in Maryland. P. Foster, D. Wichelns, R. Douglas, M. Cole. Southern Journal of Agricultural Economics. — A2816

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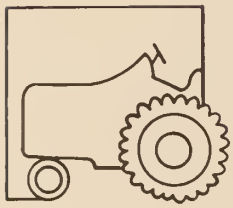

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Application of Solar Energy in the Production of Broilers. K.E. Felton, R.B. Brinsfield. American Society of Agricultural Engineers. National Energy Symposium. — A2868

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A Microprocessor-Based Water Level Recorder and Sampler Controller. R.L. Kort, A.T. Johnson, J.E. Ayers, A.D. Schlosser. American Society of Agricultural Engineers. A2899

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Psychophysiological Complexity of Respirator Wear. A.T. Johnson, C.O. Dotson. American Industrial Hygiene Association Journal. A2883

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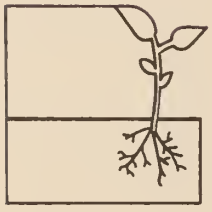

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Regularly Interstratified Chlorite-Vermiculite in Soils Over Metaigneous Mafic Rocks in Maryland. M.C. Rabenhorst, D.S. Fanning, J.E. Foss. Clays and Clay Minerals. A2826

Effects of TMV and TEV on the Growth Dynamics of Maryland Tobacco Cultivars, Nicotiana Tabacum L. I. Diallo, M.K. Corbett, C.L. Mulchi. Tobacco Science. A2818

Animal Performance on Pastures Topdressed With Liquid Sewage Sludge and Sludge Compost. A.M. Decker, R.L. Chaney, J.P. Davidson, T.S. Rumsey, S.B. Mohanty, R.C. Hammond. National Conference on Municipal and Industrial Sludge Utilization. A2819

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Multiple Herbicide Combinations for Fall Panicum Control No-Tillage Corn. J.V. Parochetti, T.C. Harris. Proceedings Northeast Weed Science Society. A2692

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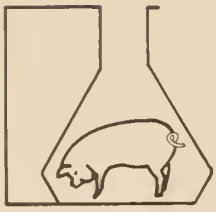

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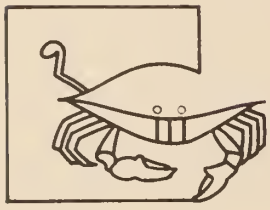

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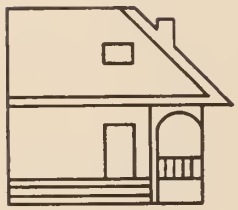

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A New Site of Action of Tunicamycin; Specific Blockage of Chitobiosyl-lipid Synthesis in Mouse L Cells. R.K. Maheshwari, I.K. Vijay, K. Olden, R.M. Friedman. Nature. A2858

Postpartum Uterine Motility Measurements in Dairy Cows Retaining Their Fetal Membranes. L.R. Martin, W.F. Williams, E. Russek, T.S. Gross. Theriogenology. A2839

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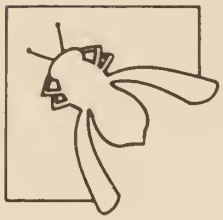

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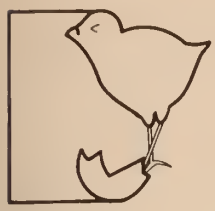

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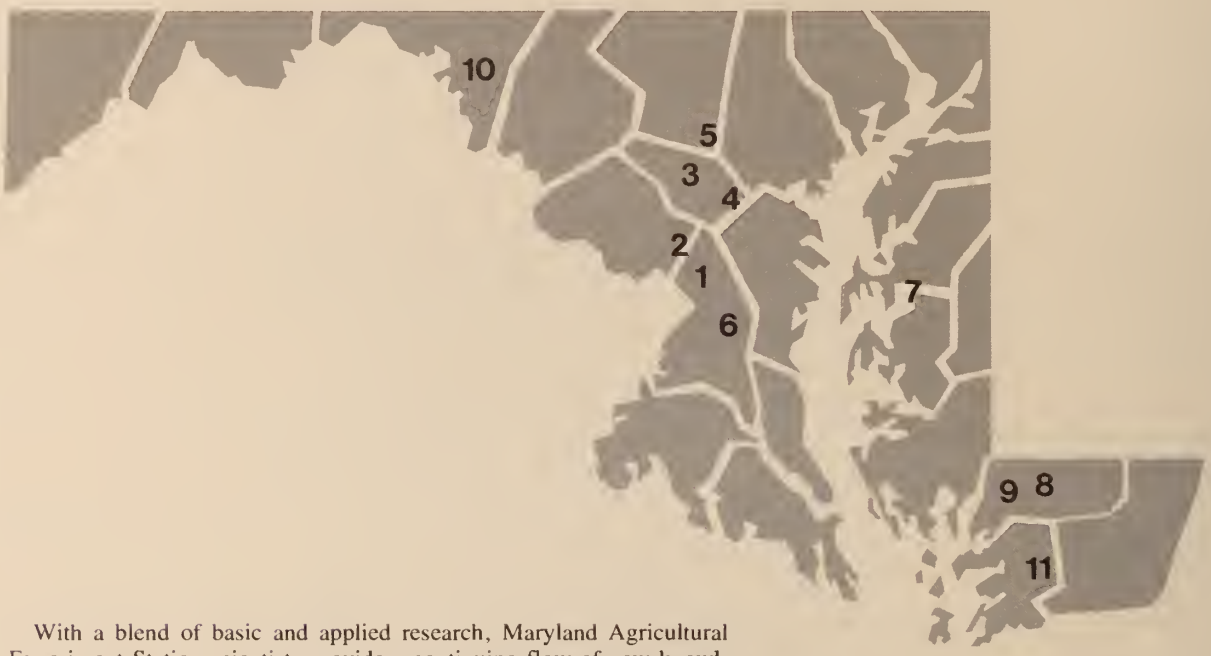
Maryland's Research Farms



With a blend of basic and applied research, Maryland Agricultural Experiment Station scientists provide a continuing flow of new knowledge essential to the solution of the practical problems facing farmers today. The Experiment Station carries out its research programs at field stations located across the state, reflecting the regional differences of Maryland farming.

Visitors are always welcome at the Experiment Station field stations. Please contact the station for specific information on location and hours of operation.

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2 **Plant Research Farm** (Montgomery county)
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3 **Agronomy-Dairy Forage Farm** (Howard county)
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4 **Horse Research Center** (Howard county)
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5 **Beef Research Center** (Carroll county)
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6 **Tobacco Research Farm** (Carroll county)
Research relating to tobacco breeding, production, harvesting and curing. 206 acres. (301) 627-3273.

7 **Wye Research Center** (Queen Anne's county)
Work on plant breeding, weed and disease control, and production systems for corn, soybeans, vegetables and ornamentals. 125 acres. Additional research in cooperation with Wye Institute. 220 acres. Work with Wye Angus herd. Approximately 400 acres on Wye Plantation. (301) 827-7388.

8 **Salisbury Research Substation** (Wicomico county)
Experimental studies dealing with poultry and breeding, insect, pest and disease control, production systems and management and processing of vegetable crops. 89 acres. (301) 742- 8788.

9 **Poplar Hill Research Farm** (Wicomico county)
Studies of disease control, breeding, pest control and production systems for corn, soybeans and vegetable crops. 100 acres. (301) 742-9644.

10 **Sharpsburg Research and Education Center** (Washington county)
Research on fruits, vegetables, ornamentals, field crops, soils and disease and insect control. 546 acres. (301) 578-6718.

11 **University of Maryland Eastern Shore**
MAES 1890 Agricultural Research Program
Research work in human nutrition, pest control and cultural practices for soybeans and corn, small farm development, child development. (301) 651-1598.

Financial Statement 1979-80

Sources of Income (State FY 80)

Hatch Formula Funds	$1,195,486
Hatch Regional Funds	421,562
McIntire-Stennis Funds	182,500
Rural Development Funds	13,000
Animal Health Funds	60,269
Total Federal Funds	1,872,817
Farm Sales	335,611
State Appropriations per State FY 80 Budgets	4,172,902
Total Funds	**$6,381,330**

Expenditures by Major Research Areas

	Percentage	Amount
Natural Resources and Environmental Quality	6	$ 382,880
Forestry Production	8	510,506
Field and Horticultural Crops	44	2,807,785
Animals and Poultry	29	1,850,586
People, Communities and Institutions: Nutrition, Food Safety, Clothing and Housing	6	382,880
Marketing, Trade, Price and Income Policy	4	255,253
General Resource Technology	3	191,440
Total	**100**	**$6,381,330**